

Application No.: 09/677637

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Amendments to the Claims:

Please amend claim 69 to correct a typographical error. Please add claims 85-93 to this application. Claims 33-36, 38-62, and 64-93 are now pending in this application.

The following Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

33. (previously presented) A filtering face mask that comprises:

- (a) a mask body that is adapted to fit over the nose and mouth of a wearer; and
- (b) an exhalation valve that is attached to the mask body, the exhalation valve

comprising:

- (1) a valve seat that comprises:

- (i) a seal surface; and
 - (ii) an orifice that is circumscribed by the seal surface;

- (2) a single flexible flap that has a fixed portion and a free portion and first and second opposing ends, the first end of the single flexible flap being associated with the fixed portion of the flap so as to remain at rest during an exhalation, and the second end being associated with the free portion of the flexible flap so as to be lifted away from the seal surface during an exhalation, the second end also being located below the first end when the filtering face mask is worn on a person, the flexible flap being positioned on the valve seat such that the flap is pressed towards the seal surface in an abutting relationship therewith, under any orientation of the valve, when no external forces from the movement of fluid are exerted upon the flap; and

- (3) a valve cover that is disposed over the valve seat and that comprises:

- (i) an opening that is disposed directly in the path of fluid flow when the free portion of the flexible flap is lifted from the seal surface during an exhalation;

- (ii) a fluid impermeable ceiling that increases in height in the direction of the flexible flap from the first end to the second end; and

- (iii) cross members that are disposed within the opening of the valve cover.

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34. (previously presented) The filtering face mask of claim 33, wherein the opening in the valve cover is approximately parallel to the path traced by the second end of the flexible flap during its opening and closing.

35. (previously presented) The filtering face mask of claim 33, wherein the valve cover and its opening direct exhaled fluid flow downwards when the mask is worn on a person.

36. (previously presented) The filtering face mask of claim 35, wherein the valve cover has fluid-impermeable sidewalls.

37. (canceled)

38. (previously presented) The filtering face mask of claim 33, wherein the opening in the valve cover is at least the size of the orifice in the valve seat.

39. (previously presented) The filtering face mask of claim 33, wherein the valve seat is made from a relatively light-weight plastic that is molded into an integral one-piece body.

40. (previously presented) The filtering face mask of claim 39, wherein the valve seat has been made by an injection molding technique.

41. (previously presented) The filtering face mask of claim 33, wherein the seal surface is substantially uniformly smooth to insure that a good seal occurs between the single flexible flap and the seal surface, and wherein the flexible flap is made from a material that is capable of allowing the flap to display a bias towards the seal surface.

42. (previously presented) The filtering face mask of claim 33, wherein the flexible flap would normally assume a flat configuration when no forces are applied to it but has a curved profile when viewed from a side elevation resting against the seal surface.

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43. (previously presented) The filtering face mask of claim 33, wherein the flexible flap is elastomeric and is resistant to permanent set and creep.

44. (previously presented) The filtering face mask of claim 42, wherein the flexible flap is made from an elastomeric rubber.

45. (previously presented) The filtering face mask of claim 33, wherein the flexible flap has a stress relaxation sufficient to keep the flexible flap in an abutting relationship to the seal surface under any static orientation for 24 hours at 70 °C.

46. (previously presented) The filtering face mask of claim 45, wherein the flexible flap provides a leak-free seal according to the standards set forth in 30 C.F.R. § 11.183-2, July 1, 1991.

47. (previously presented) The filtering face mask of claim 33, wherein the flexible flap is made from a crosslinked polyisoprene.

48. (previously presented) The filtering face mask of claim 33, wherein the flexible flap has a Shore A hardness of about 30 to 50.

49. (previously presented) The filtering face mask of claim 33, wherein the flexible flap has a generally uniform thickness of about 0.2 to 0.8 millimeters.

50. (previously presented) The filtering face mask of claim 49, wherein the flexible flap has a generally uniform thickness of about 0.3 to 0.6 millimeters.

51. (previously presented) The filtering face mask of claim 50, wherein the flexible flap has a generally uniform thickness of about 0.35 to 0.45 millimeters.

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52. (previously presented) The filtering face mask of claim 33, wherein the one free portion of the flexible flap has a profile that comprises a curve when viewed from the front, which curve is cut to correspond to the general shape of the seal surface.

53. (previously presented) The filtering face mask of claim 52, wherein the flexible flap is greater than one centimeter wide.

54. (previously presented) The filtering face mask of claim 53, wherein the flexible flap is 1.2 to 3 centimeters wide and is about 1 to 4 centimeters long.

55. (previously presented) The filtering face mask of claim 33, wherein the fixed portion of the flexible flap is about 10 to 25 percent of the total circumferential edge of the flexible flap, with the remaining 75 to 90 percent being free to be lifted from the seal surface.

56. (previously presented) The filtering face mask of claim 33, wherein the valve seat includes a flange that provides a surface onto which the exhalation valve can be secured to the mask body, and wherein the flange extends 360 degrees around the valve seat where the valve seat is mounted to the mask body.

57. (previously presented) The filtering face mask of claim 33, wherein the flexible flap is positioned on the valve such that exhaled air is deflected downward during an exhalation when the filtering face mask is worn on a person.

58. (previously presented) The filtering face mask of claim 33, wherein the orifice in the valve seat comprises cross members that create a plurality of openings within the orifice.

59. (previously presented) The filtering face mask of claim 33, wherein a high percentage of the exhaled air is purged through the exhalation valve.

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60. (previously presented) The filtering face mask of claim 33, wherein at least 60 percent of the total airflow flows through the exhalation valve under a normal exhalation test.

61. (previously presented) The filtering face mask of claim 60, wherein at least 73 percent of the total airflow flows through the exhalation valve under a normal exhalation test.

62. (previously presented) The filtering face mask of claim 33, wherein the exhalation valve is positioned on the mask body substantially opposite to a wearer's mouth, and wherein the flexible flap is mounted to the valve seat in cantilever fashion.

63. (canceled)

64. (previously presented) The filtering face mask of claim 33, wherein the shape of the orifice does not wholly correspond to the shape of the seal surface.

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65. (previously presented) A filtering face mask that comprises:
- (a) a mask body that is adapted to fit over the nose and mouth of a wearer; and
 - (b) an exhalation valve that is attached to the mask body, the exhalation valve comprising:
 - (1) a valve seat that comprises:
 - (i) a seal surface; and
 - (ii) an orifice that is surrounded by the seal surface.
 - (2) a single flexible flap that is supported by the valve seat and that has a stationary portion and only one free portion and a peripheral edge that includes stationary and free segments, the stationary segment of the single flexible flap's peripheral edge being associated with the stationary portion of the flap so as to remain at rest during an exhalation, and the free segment of the flap's peripheral edge being associated with the free portion of the flexible flap so as to be lifted away from the seal surface during an exhalation, the free segment also being located below the stationary segment when the filtering face mask is worn on a person, the flexible flap being positioned on the valve seat such that the flap is pressed towards the seal surface in an abutting relationship therewith, under any orientation of the valve, when no external forces from the movement of fluid are exerted upon the flap; and
 - (3) a valve cover that is disposed over the valve seat and that comprises:
 - (i) an opening that is disposed directly in the path of fluid flow when the free portion of the flexible flap is lifted from the seal surface during an exhalation;
 - (ii) a fluid impermeable ceiling that is spaced further from the valve seat above the free segment of the flap's peripheral edge than above the stationary segment of the flap's peripheral edge; and
 - (iii) cross members that are disposed within the opening of the valve cover.

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66. (previously presented) A filtering face mask that comprises:
- (a) a mask body that is adapted to fit over the nose and mouth of a wearer; and
 - (b) an exhalation valve that is attached to the mask body, the exhalation valve comprising:
 - (1) a valve seat that comprises:
 - (i) a seal surface; and
 - (ii) an orifice that is circumscribed by the seal surface.
 - (2) a single flexible flap that is supported by the valve seat and that has a stationary portion and only one free portion and a peripheral edge that includes stationary and free segments, the stationary segment of the single flexible flap's peripheral edge being associated with the stationary portion of the flap so as to remain at rest during an exhalation, and the free segment of the flap's peripheral edge being associated with the free portion of the flexible flap so as to be lifted away from the seal surface during an exhalation, the free segment also being located below the stationary segment when the filtering face mask is worn on a person, the flexible flap being positioned on the valve seat such that the flap is pressed towards the seal surface in an abutting relationship therewith, under any orientation of the valve, when no external forces from the movement of fluid are exerted upon the flap; and
 - (3) a valve cover that is disposed over the valve seat and that comprises:
 - (i) an opening that is disposed directly in the path of fluid flow when the free portion of the flexible flap is lifted from the seal surface during an exhalation;
 - (ii) a fluid impermeable ceiling that is higher above the free segment of the flap's peripheral edge than above the stationary segment of the flap's peripheral edge; and
 - (iii) cross members that are disposed within the opening of the valve cover;
- wherein during an exhalation, the free portion of the flexible flap lifts from the seal surface and moves towards the fluid impermeable ceiling so that exhaled air can exit through the opening in the valve cover.

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67. (previously presented) A filtering face mask that comprises:
- (a) a mask body that is adapted to fit over the nose and mouth of a wearer; and
 - (b) an exhalation valve that is attached to the mask body, the exhalation valve comprising:
 - (1) a valve seat that comprises:
 - (i) an orifice; and
 - (ii) a seal surface that surrounds the orifice when the valve seat is viewed from the front;
 - (2) a single flexible flap that is supported by the valve seat and that has a stationary portion and a free portion and a peripheral edge that includes stationary and free segments, the stationary segment of the single flexible flap's peripheral edge being associated with the stationary portion of the flap so as to remain at rest during an exhalation, and the free segment of the flap's peripheral edge being associated with the free portion of the flexible flap so as to be lifted away from the seal surface during an exhalation, the free segment also being located below the stationary segment when the filtering face mask is worn on a person, the flexible flap being positioned on the valve seat such that the flap is pressed towards the seal surface in an abutting relationship therewith, under any orientation of the valve, when no external forces from the movement of fluid are exerted upon the flap; and
 - (3) a valve cover that is disposed over the valve seat and that comprises:
 - (i) an opening that is disposed in the path of fluid flow when the free portion of the flexible flap is lifted from the seal surface during an exhalation; and
 - (ii) a fluid impermeable ceiling that is higher above the free segment of the flap's peripheral edge than above the stationary segment of the flap's peripheral edge;
- wherein during an exhalation, the free portion of the flexible flap lifts from the seal surface and moves toward the fluid impermeable ceiling so that exhaled air can exit through the opening in the valve cover.

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68. (previously presented) The filtering face mask of claim 67, wherein the single flexible flap has only one free portion.

69. (currently amended) A filtering face mask that comprises:

(a) a mask body that is adapted to fit over the nose and mouth of a wearer; and
(b) an exhalation valve that is attached to the mask body, the exhalation valve comprising:

(1) a valve seat that comprises:

(i) a seal surface; and

(ii) an orifice that is circumscribed by the seal surface[[.]];.

(2) a single flexible flap that has a fixed portion and a free portion and first and second opposing ends, the first end of the single flexible flap being associated with the fixed portion of the flap so as to remain at rest during an exhalation, and the second end being associated with the free portion of the flexible flap so as to be lifted away from the seal surface during an exhalation, the second end also being located below the first end when the filtering face mask is worn on a person, the flexible flap being positioned on the valve seat such that the flap is pressed towards the seal surface in an abutting relationship therewith, under any orientation of the valve, when no external forces from the movement of fluid are exerted upon the flap; and

(3) a valve cover that is disposed over the valve seat and that comprises:

(i) an opening that is disposed directly in the path of fluid flow when the free portion of the flexible flap is lifted from the seal surface during an exhalation; and

(ii) a fluid impermeable ceiling that has an interior that has a means for preventing the free end of the flexible flap from adhering to the fluid-permeable ceiling when moisture is present on the ceiling or on the flexible flap.

70. (previously presented) The filtering face mask of claim 69, wherein the means for prevent the free end of the flexible flap from adhering to the ceiling includes a ribbed or coarse pattern or release surface.

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71. (previously presented) A filtering face mask that comprises:
- (a) a mask body;
 - (b) an exhalation valve that is attached to the mask body, the exhalation valve comprising an orifice, a valve seat that has a seal surface, and a flexible flap that has a stationary portion and a free portion, the stationary portion of the flexible flap remaining essentially stationary when a fluid is passing through the orifice during an exhalation while the free portion being lifted from the seal surface in response to a force from the fluid; and
 - (c) a valve cover that is attached to the valve seat, the valve cover comprising a means for preventing the free portion of the flexible flap from adhering to the valve cover when the flexible flap is lifted from the seal surface during the exhalation and when moisture is present on the valve cover and/or flexible flap.
72. (previously presented) The filtering face mask of claim 71, wherein the means for preventing adhering comprises a rib that is located on an interior of a ceiling of the valve cover.
73. (previously presented) The filtering face mask of claim 71, wherein the means for preventing adhering comprises a course pattern that is located on an interior of a ceiling of the valve cover.
74. (previously presented) The filtering face mask of claim 71, wherein the flexible flap is secured to the valve seat at the stationary portion of the flexible flap.
75. (previously presented) The filtering face mask of claim 74, wherein the flexible flap is secured to the valve seat in cantilevered fashion.

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76. (previously presented) A filtering face mask that comprises:
- (a) a mask body;
 - (b) an exhalation valve that is attached to the mask body, the exhalation valve comprising an orifice, a valve seat that has a seal surface, and a flexible flap that has a stationary portion and a free portion, the stationary portion of the flexible flap remaining essentially stationary when a fluid is passing through the orifice during an exhalation while the free portion being lifted from the seal surface in response to a force from the fluid; and
 - (c) a valve cover that is attached to the valve seat, the valve cover comprising a ceiling that has an interior surface, the interior surface having a ribbed or coarse pattern or release surface to prevent the free portion of the flexible flap from sticking to the ceiling when the free portion of the flexible flap is lifted away from the seal surface.
77. (previously presented) The filtering face mask of claim 76, wherein the flexible flap is secured to the valve seat at the stationary portion of the flexible flap.
78. (previously presented) The filtering face mask of claim 76, wherein the flexible flap is secured to the valve seat in cantilevered fashion.

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79. (previously presented) A filtering face mask that comprises:
- (a) a mask body that is adapted to fit over the nose and mouth of a wearer and that comprises a filtration layer; and
 - (b) an exhalation valve that is attached to the mask body, the exhalation valve comprising:
 - (1) a valve seat that comprises:
 - (i) a seal surface; and
 - (ii) an orifice that is surrounded by the seal surface;
 - (2) a flexible flap that is supported by the valve seat and that has a stationary portion and a free portion and a peripheral edge that includes stationary and free segments, the stationary segment of the flexible flap's peripheral edge being associated with the stationary portion of the flap so as to remain at rest during an exhalation, and the free segment of the flap's peripheral edge being associated with the free portion of the flexible flap so as to be lifted away from the seal surface during an exhalation; and
 - (3) a valve cover that is disposed over the valve seat and that comprises:
 - (i) an opening through which exhaled air passes when the free portion of the flexible flap is lifted from the seal surface during an exhalation; and
 - (ii) a fluid impermeable ceiling that is spaced further from the valve seat above the free segment of the flap's peripheral edge than above the stationary segment of the flap's peripheral edge.
80. (previously presented) The filtering face mask of claim 79, wherein the valve cover opening comprises cross members, and wherein the exhalation valve is attached to the mask body directly in front of where a wearer's mouth would be when the mask is worn, and wherein essentially an entire exposed surface of the mask body is fluid permeable to air during an inhalation.
81. (previously presented) The filtering face mask of claim 79, wherein the flap is mounted to the valve seat in cantilevered fashion.

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82. (previously presented) The filtering facemask of claim 79, wherein the opening in the valve cover is at least the size of the orifice in the valve seat.

83. (previously presented) The filtering face mask of claim 82, wherein the opening in the valve cover is larger than the size of the orifice in the valve seat.

84. (previously presented) The filtering face mask of claim 79, wherein the valve cover opening is disposed directly in the path of exhaled air flow.

85. (new) A filtering face mask that comprises:

(a) a mask body that is adapted to fit over the nose and mouth of a wearer and that comprises a filtration layer; and

(b) an exhalation valve that is attached to the mask body, the exhalation valve comprising:

(1) a valve seat that comprises:

(i) a seal surface; and

(ii) an orifice that is surrounded by the seal surface;

(2) a flexible flap that is supported by the valve seat and that has a stationary portion and a free portion, the flexible flap being mounted to the valve seat at the stationary portion of the flap, the stationary portion of the flap remaining essentially stationary during an exhalation, and the free portion being free to be lifted away from the seal surface during an exhalation; and

(3) a valve cover that is disposed over the valve seat and that comprises:

(i) an opening through which exhaled air passes when the free portion of the flexible flap is lifted from the seal surface during an exhalation; and

(ii) a fluid impermeable ceiling that is greater in height above the opening in the valve cover than above a portion of the fluid impermeable ceiling opposite the opening.

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86. (new) The filtering face mask of claim 85, wherein the valve cover opening comprises cross members, and wherein the exhalation valve is attached to the mask body directly in front of where a wearer's mouth would be when the mask is worn.

87. (new) The filtering face mask of claim 86, wherein the flap is mounted to the valve seat in cantilevered fashion.

88. (new) The filtering facemask of claim 85, wherein the opening in the valve cover is at least the size of the orifice in the valve seat.

89. (new) The filtering face mask of claim 88, wherein the opening in the valve cover is larger than the size of the orifice in the valve seat.

90. (new) The filtering face mask of claim 85, wherein the valve cover opening is disposed directly in the path of exhaled air flow.

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91. (new) A filtering face mask that comprises:
- (a) a mask body that is adapted to fit over the nose and mouth of a wearer and that comprises a filtration layer; and
 - (b) an exhalation valve that is attached to the mask body and that comprises:
 - (1) a valve seat that comprises:
 - (i) a seal surface; and
 - (ii) an orifice that is surrounded by the seal surface;
 - (2) a flexible flap that is mounted to the valve seat and that has a free portion that is free to be lifted away from the seal surface during an exhalation, the free portion of the flexible flap remaining in contact with the seal surface when a wearer of the mask is not exhaling; and
 - (3) a valve cover that is disposed over the valve seat and that comprises:
 - (i) a fluid impermeable sidewall;
 - (ii) a fluid impermeable ceiling; and
 - (iii) an opening through which exhaled air passes;
- wherein the opening is located opposite at least a portion of the sidewall, and wherein the fluid impermeable ceiling is spaced further from the valve seat adjacent the opening than adjacent the portion of the sidewall opposite the opening.

92. (new) The filtering face mask of claim 19, wherein the opening includes cross members that divide the opening into a plurality of ports.

93. (new) The filtering face mask of claim 91, wherein the sidewall, the fluid impermeable ceiling, and the opening are disposed on the valve cover and the exhalation valve is oriented on the mask body such that when a wearer of the mask exhales, the exhaled air is directed in a downward direction.

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